



To discuss this course and customizations:  
Call: 434-509-5680 or Email: [sales@cloudcontraptions.com](mailto:sales@cloudcontraptions.com)

## SQL Fundamentals

### Class Duration

14 hours of live training delivered over 2 days.

### Student Prerequisites

- Comfortable working with data in some form (spreadsheets, code, or reports)
- Basic familiarity with running commands or using developer tools
- No prior SQL or database experience required

### Target Audience

This course is designed for developers and analysts who are new to SQL: application developers who have leaned on ORMs or AI assistants without understanding the queries underneath, data analysts moving beyond spreadsheets, and anyone who needs to read, write, and reason about relational queries with confidence. The course is taught on PostgreSQL 18 but teaches standard SQL first, so the skills transfer directly to other relational databases.

### Description

SQL Fundamentals gives participants a solid, durable foundation in the SQL language. The course is standards-first — grounded in the current SQL:2023 international standard — and taught hands-on using PostgreSQL 18, the latest major release of the world's most popular open source database. Participants begin with the relational model: tables, rows, keys, and why relational thinking has outlasted decades of alternatives. From there the course builds query skills layer by layer: SELECT fundamentals, filtering and sorting, joins of every type taught visually with diagrams before syntax, aggregation with GROUP BY and HAVING, subqueries and common table expressions, and a gentle introduction to window functions.

The second day turns to working with data rather than just reading it: INSERT, UPDATE, and DELETE; transaction basics and why atomicity matters; constraints and keys as the database's built-in safety net; and the practical realities of NULL semantics and data type choices. Participants develop intuition for when indexes help, learn to read simple execution plans without



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fear, and adopt query style habits that make SQL readable by teammates. The course closes with a timely topic: working with SQL in the age of AI assistants — how to review, verify, and correct generated SQL rather than trusting it blindly.

## Learning Outcomes

- Explain the relational model: tables, rows, columns, keys, and relationships
- Write SELECT queries with confidence, from single-table lookups to multi-table reports
- Filter and sort result sets precisely with WHERE, ORDER BY, LIMIT, and DISTINCT
- Choose and write the correct join — inner, left, right, full, and cross — for any question
- Summarize data with aggregate functions, GROUP BY, and HAVING
- Decompose complex questions with subqueries and common table expressions (CTEs)
- Apply basic window functions for rankings and running totals
- Insert, update, and delete data safely, including the RETURNING clause
- Use transactions to group changes atomically with BEGIN, COMMIT, and ROLLBACK
- Read and define constraints: primary keys, foreign keys, unique, not-null, and check
- Reason correctly about NULL in comparisons, aggregates, and joins
- Select appropriate data types for text, numbers, dates, times, and booleans
- Develop intuition for when an index will and will not help a query
- Read a basic EXPLAIN plan and spot a sequential scan versus an index scan
- Critically review SQL produced by AI assistants for correctness, safety, and performance

## Training Materials

Comprehensive courseware is distributed online at the start of class. All students receive a downloadable MP4 recording of the training.



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## Software Requirements

Students will need a free, personal GitHub account to access the courseware, Docker Desktop or Podman to run PostgreSQL 18 locally, and a SQL client (VS Code with the PostgreSQL extension, pgAdmin, or psql). If students are unable to configure a local environment, a cloud-based environment can be provided.

## Training Topics

### The Relational Model and SQL

- Tables, rows, columns, and schemas
- Keys and relationships between tables
- The SQL standard: what SQL:2023 covers and why it matters
- PostgreSQL 18 as our teaching database
- Standard SQL vs. database-specific dialects
- Setting up and connecting to PostgreSQL

### SELECT Fundamentals

- Anatomy of a query
- Selecting columns and expressions
- Column aliases and computed values
- DISTINCT and removing duplicates
- Logical query processing order: how SQL actually evaluates

### Filtering and Sorting

- WHERE with comparison and logical operators
- BETWEEN, IN, and LIKE pattern matching
- Case sensitivity and string comparisons
- ORDER BY: single and multiple sort keys
- LIMIT, OFFSET, and standard FETCH FIRST

### Joins, Taught Visually

- Why data lives in multiple tables
- INNER JOIN: matching rows, drawn before written
- LEFT and RIGHT OUTER JOIN: keeping the unmatched
- FULL OUTER JOIN and CROSS JOIN
- Self-joins
- Join conditions vs. filter conditions



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- Multi-table joins step by step

### Aggregation and GROUP BY

- COUNT, SUM, AVG, MIN, MAX
- GROUP BY: one row per group
- HAVING vs. WHERE
- Grouping by multiple columns
- Common aggregation mistakes and how to spot them

### Subqueries and CTEs

- Scalar subqueries in SELECT and WHERE
- IN, EXISTS, and correlated subqueries
- Derived tables in FROM
- Common table expressions with WITH
- Refactoring nested queries into readable CTEs

### Window Functions: An Introduction

- What windows add beyond GROUP BY
- ROW\_NUMBER, RANK, and DENSE\_RANK
- Running totals with SUM OVER
- PARTITION BY and ORDER BY in windows
- When to reach for a window function

### Modifying Data

- INSERT: single rows, multiple rows, and from queries
- UPDATE with precise WHERE clauses
- DELETE and the danger of the missing WHERE
- The RETURNING clause for seeing what changed

### Transactions Basics

- Atomicity: all or nothing
- BEGIN, COMMIT, and ROLLBACK
- Autocommit behavior in clients
- A first look at concurrent access and isolation

### Constraints and Keys

- Primary keys and surrogate vs. natural keys
- Foreign keys and referential integrity
- UNIQUE, NOT NULL, and CHECK constraints



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- DEFAULT values
- How constraints catch bugs before they become data

### NULL Semantics and Data Types

- NULL: unknown, not zero, not empty
- Three-valued logic in WHERE clauses
- NULL in aggregates, joins, and sorting
- COALESCE and NULLIF
- Text, numeric, date/time, and boolean types
- Choosing types: common mistakes to avoid

### Indexing Intuition and Execution Plans

- What an index is and what it costs
- When indexes help: lookups, joins, sorts
- When they do not: small tables, low selectivity
- Reading EXPLAIN gently: scans, joins, and estimates
- Asking the database why a query is slow

### Query Readability and Style

- Formatting conventions that aid review
- Naming, aliasing, and commenting queries
- Building complex queries incrementally
- Writing SQL your teammates can maintain

### SQL in the Age of AI Assistants

- What AI assistants do well and poorly with SQL
- Reviewing generated queries: correctness, NULL handling, joins
- Verifying results against known answers
- Safety: generated UPDATE and DELETE statements
- Using AI as an accelerator, not a substitute for understanding